

THE MURPHY CHEMICAL COMPANY LIMITED,
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ADVISORY BULLETIN No. 12

The Apple Sawfly

(Advisory Bulletin No. 3 revised).

WITH NOTES ON

The Codlin Moth.

KEEP THESE BULLETINS IN THE GRATIS FILING
COVER WE SUPPLY.

The Apple Sawfly.

LIFE HISTORY.

The adults emerge from cocoons in the soil, during late April or early May. One or more eggs may be laid within each blossom. Their presence can be detected, without opening the flower, by looking for a rusty brown scar on the side of one of the sepals, just below the calyx cup. Each scar represents the point where the ovipositor of the female was inserted to deposit the egg.

The egg hatches from one to three weeks after oviposition. Very shortly after hatching, the larva (grub or maggot) generally leaves the calyx cup and after crawling on the outside of the fruit, quickly bores its way into the developing fruitlet from the side.

After feeding in the centre of the fruit for about a week to ten days, the larva generally comes out at night and burrows into a clean fruit. It continues its feeding here for some days, frequently coming out at night and returning inside in the early morning. It may, in this manner, attack one or two more fruits before becoming fully fed, towards the end of June. It then drops to the ground, where it spins a tough, parchment-like cocoon in the top nine inches of soil. Here it remains until the following spring, when it pupates within this cocoon and emerges as an adult next April or May.

NATURE OF DAMAGE.

The fruits attacked by the new-hatched larvæ generally fail to develop and either drop to the ground or sometimes remain on the trees from one year to another as shrivelled, mummified, very small fruitlets. The fruits attacked later, by migrating larvæ, also drop to the ground; the centre of the apple is filled with brown or black frass which also protrudes from a hole in the side. One common feature of a Sawfly attack is the presence of ribbon-like scars which may be found on the fruit when picked. These are due to the larvæ failing in their attempt to bite their way in through the skin and should not be confused with the wider, irregular scars caused by Apple Capsids.

The early-flowering varieties are not often attacked to any great extent. Worcester, Newton, Derby, Grieve, Annie Elizabeth, Lane and other mid-season and late-flowering varieties generally suffer the most.

CONTROL.

It has been known now for some time that the best control is obtained by the use of a Nicotine wash against the unhatched eggs. This method has given excellent results, especially when applied on a warm day. If dull, cold weather conditions prevail, then it is advisable to wait if possible until warm weather occurs before applying the spray. It is important that the lance should be held up just above each blossom cluster and the wash forced down into the blooms with a high pressure, so that it can penetrate right into the calyx. For this purpose, a lance with the nozzle bent at an angle of about 45 degrees is the most efficient. Particular care is necessary to see that every blossom cluster is sprayed, especially those on the upper branches, where Sawfly attack is generally the most severe.

It is essential to use a coarser nozzle than is generally employed for Scab sprays, otherwise the wash will not penetrate into the blooms. A coarse driving spray is necessary; a mist-like spray is of little value. A thorough wetting of the centre of the flowers and of the young fruitlets, must be given. We recommend the adoption of one of the methods of control outlined below.

METHOD I.

On varieties of apples which do not normally receive any post-blossom treatment for Scab, or if it is desired to keep separate the Lime Sulphur and Nicotine applications, use the following formulæ:—

Nicotine (95/98%)	8-10 oz.	Nicotine	8-10 oz.
Soft Soap	8-10 lbs.	or Wetter and Penetrant*	
Water	100 gallons.	Water	100 gallons.

Apply at petal fall (i.e., when 80% of the blossoms have fallen) or within a week of that date. For very

**The amount of Wetter and Penetrant depends on the material used.*

severe infestation of Sawfly make a second application about a week after the first or 7-10 days after petal fall.

Where it is not possible to spray each separate variety at petal fall, then take Worcester as guide and apply the wash to all varieties when Worcester is ready to spray. When estimating the extent of infestation look for the little rusty coloured scars on the side of the blossoms and be sure to examine the upper as well as the lower branches, as Sawfly infestation is generally worst at the top of the tree.

METHOD II.

For most varieties of apples, where a mixed or "omnibus" wash is desired to control Scab and Caterpillar as well as Sawfly, use the following formula:—

Nicotine (95/98%)	...	...	8-10 ozs.
Lead Arsenate	...	2 lbs. powder or 4 lbs. paste.	
Wetter and Penetrant*			
Lime Sulphur	...	...	... (see below).
Water	...	...	Make up to 100 gallons.

In order to avoid the risk of Sulphur scorch, since the trees must be drenched, it is advisable to reduce the concentration of the Lime Sulphur from 1 in 60 to 1 in 80 for most varieties and from 1 in 100 to 1 in 120 for varieties such as Cox, Lane, Bath, Rival and Grieve.

Apply at petal fall (*i.e.* when 80% of the blossoms have fallen) or within a week of that date.

In the case of a severe attack of Sawfly make a second application about a week after the first, or 7-10 days after petal fall.

Bordeaux Mixture can be substituted for Lime Sulphur in the above formula, but the amount of Copper Sulphate should be reduced from 8 to 6 lbs., to give a 6-8-100 Bordeaux Mixture.

If two applications are given, then, if desired, the Lime Sulphur or Bordeaux can be omitted from the first application and given only in the second. Where it is not possible to spray each separate variety at petal fall then take Worcester as guide and apply the wash to all varieties when Worcester is ready to spray. A second application a week later, is then advisable.

*The amount of Wetter and Penetrant depends on the material used.

METHOD III.

The two methods outlined above will give the best control of Sawfly. If however, it is desired to control Caterpillar as well as Sawfly and not to use Lead Arsenate, because of its poisonous nature, then the Lead and Nicotine can be replaced by a high grade Derris Powder. The use of Derris Powder is also advocated if dull, cold weather conditions prevail, when Nicotine would not be effective. Derris will kill the newly hatched larvæ, but it is ineffective against the eggs so that it does not give as good control as Nicotine, except in dull cold weather.

When using Derris use the following formula :—

Derris Powder	...	...	...	2 lbs.
Wetter and Penetrant				} As in Method II.
Lime Sulphur or Bordeaux				
Water	...	...	Make up to 100 gallons.	

The Derris Powder should be finely ground and of the current season's supply. The Rotenone content of the diluted wash should be 0.0035—0.004%. If desired, Derris already combined with a Wetter and Penetrant should be used, instead of mixing the Derris and Wetting agent separately. In this case, use 4 lbs. of the combined Derris compound per 100 gallons wash.

Derris containing washes are ineffective against the eggs; therefore they must be applied just as the first eggs are hatching; this is generally 4-8 days after petal fall. In the case of a severe attack, a second application should be given about a week after the first, or 10-14 days after petal fall.

METHOD IV.

The first two methods aim at killing the eggs and so keeping the fruit entirely undamaged. The third method aims at killing the larvæ as they hatch and try to bore into the apple. If it has not been possible to apply any of these methods, the use of a Derris Dust, directed against the migrating larvæ, gives a good measure of control. It should be borne in mind, however, that about 25% of the crop will already have been affected, if no attempt is made to control the pest until the larvæ migrate from one fruit to another.

The fruit should be examined about fourteen days after petal fall and if injured fruits with a hole in the side or a tunnel under the skin, are seen in any numbers, a Derris Dust should be applied immediately. A second dusting a week later is advisable. If the dust is washed off by rain within 48 hours of its application then repeat without delay,

The best time for dusting is the early morning, from 4 a.m. to about 7 a.m., or in the evening, when there is little or no wind.

A fine Derris Dust, with a guaranteed Rotenone content of not less than 0.2%, should be used and the fruits thoroughly covered with the dust. About half to three-quarter cwt. of the dust per acre will generally be sufficient for each application.

The Codlin Moth.

LIFE HISTORY.

The moths appear at the end of May and throughout June; the female lays a large number of very small, oval, flat eggs, singly, on the young fruit, leaves and twigs. After about ten days the egg hatches and the young caterpillar (larva) bores its way into an apple through the "eye" (or calyx). Inside the fruit it burrows down into the centre, feeding chiefly on the core and pips. After about three to four weeks the larva is fully fed and burrows its way out of the side of the apple, which may have dropped or be still hanging on the tree, and crawls away in search of shelter. It generally crawls into a crevice under rough bark on the trunk and main branches or in rubbish at the foot of the tree; here it spins a tough silk cocoon and in a normal year the majority of the larvae remain in these cocoons over the winter until the following spring, when they turn into a pupa, or chrysalis, and the moths emerge in May or June. A few of the larvæ, however, pupate the same summer and give rise to a second brood of moths in August. During the last two or three years, owing to the exceptionally hot summers, a much larger proportion of the larvæ have pupated in

the summer so that there has been a huge increase in the amount of damage caused to fruits by this pest in the autumn. The moths emerging in August lay eggs on the leaves and fruits and the young larvæ generally enter the apples this time from the side, and not through the eye, as with the first brood. When fully fed, they emerge from the fruits and spin a cocoon in which they pass the winter under shelter of rough bark, etc.; next spring they pupate and give rise to moths in the same manner as the larvæ of the first brood.

NATURE OF DAMAGE.

The fruits attacked by the larvæ are useless for consumption, as the core and pips are eaten away, a tunnel bored to the outside and the centre filled with brown or black frass. Infected apples may drop to the ground, or, especially in the case of those attacked by the second brood in autumn, they may remain on the tree and unless the fruit is carefully graded after picking, they may unknowingly be sold for consumption or stored. In both cases they tend to rot quickly and may thus cause the infection of sound fruits near them.

DIFFERENCE FROM SAWFLY.

The larva of the Sawfly has ten pairs of legs and is plumper and more maggot-like in appearance than the Codlin Moth larva, which has only eight pairs of legs. The first brood Codlin larva enters the apple usually through the eye and feeds only on the core and pips, later, leaving the apple by the side. The Sawfly larva usually enters the apple by the side and tunnels chiefly in the fleshy part of the fruit; it also leaves through another hole by the side. The second generation Codlin larva is found in August to October and therefore, although like the Sawfly, it enters the apple from the side, it cannot be confused with it, as the Sawfly does not occur later than July. The only pest with which the second brood Codlin larva is likely to be confused is the Apple Fruit Tortrix *Cacæcia podana*, or two or three very similar Tortrix species, the chief of which is *Batodes angustiorana*. These Tortrix larvæ, however, feed only on the skin and surface layers of the

apple, so that the damage they cause can be easily distinguished from the deep tunnel to the core caused by the second brood Codlin larvæ.

CONTROL.

General orchard cleanliness, the removal of all rubbish, the scraping of rough bark off trees and the routine use of a Tar Distillate wash help to keep this pest in check. Sack banding, or corrugated paper bands, applied to the trunks as for Apple Blossom Weevil control, in early June and removed and burnt in December, will trap many larvæ. Care should be exercised in removing the bands to see that the larvæ are not left on the trunk encased in their silk cocoons. At this stage they are easily identified as the head is dark and the body cream-coloured with a decided pink tint. In order to obtain a good control, in the case of a severe infestation, the above measures should be supplemented by a Lead Arsenate spray. This should be applied as soon as the blossom is fallen and, in the case of a bad attack, a second application, given a week later, is advisable. The spray should be directed as much as possible on to the young fruitlets so as to force the poison into the "eye" of the apple, where it kills the young larva as it tries to bore its way into the fruit. If desired, the Lead can be mixed with the petal fall Lime Sulphur wash, or a mixed wash of Lead, Nicotine, Lime Sulphur and Wetter and Penetrant applied at petal fall and, again a week later, can be used to control Codlin Moth, Sawfly, Red Spider, Scab, Winter Moth and Tortrix Caterpillars all together. It is not advisable to use Derris in place of Lead Arsenate to control Codlin Moth larvæ as at present there is no information available that it would be effective.

In the case of the second brood larvæ, very little can be done to control them, so that efforts should be made to control this pest as the first brood at petal fall, so that the second brood cannot develop.

May, 1935.

We supply :—

ALVESCO LIME SULPHUR.

ALVESCO BORDEAUX PASTE.

ALVESCO LEAD ARSENATE,
Powder and Paste.

ALVESCO INSECTICIDE SOAP.

SPREADITE.

Wetter, Spreader, Sticker and Penetrant, for use in mixed or "omnibus" washes or where Soap is not desired.

NICOTINE.

Guaranteed 95/98% and British.

GARANTONE DERRIS POWDER.

Guaranteed 2% Rotenone content; used at 2 lbs. per 100 gallons will give a wash of desired standard of 0.0035 to 0.004% Rotenone.

MORTO. Combined Derris and Spreader.

Contains an efficient Wetter, Spreader, Sticker and Penetrant. Guaranteed Rotenone content; used at 4 lbs. per 100 gallons will give a wash of desired standard of 0.0035 to 0.004% Rotenone.

ROTOMORT DERRIS DUST.

Guaranteed Rotenone content of 0.2%

Lime Sulphur, Lead Arsenate, Insecticide Soap and Nicotine are standard products for which specifications appear in Bulletin No. 82 of the Ministry of Agriculture and Fisheries. The above materials conform to these specifications.